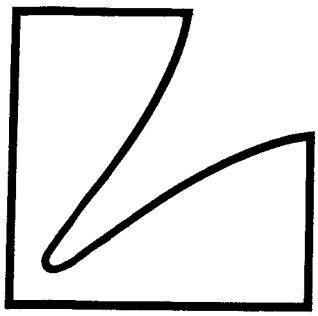


SOLID STATE POWER AMPLIFIER

M-6000

SERVICE MANUAL

MODEL: M-6000 POWER AMPLIFIER

C I R C U I T D E S C R I P T I O N

Emitter Follower Circuit

Output signals of a control amplifier etc. are led to the input terminals (MAIN IN) of this power amp, and level-controlled at the input level control of a detent volume equivalent to the high-grade attenuator with 22 contact-points of 1dB decrement.

Then fed into the Emitter Follower circuit, which is, unlike the ordinary one, composed by two transistors Q601 and Q602. The former is for emitter follower and the latter is for the constant current drive of the emitter follower of Q601. Signals are impedance-converted through this circuit, and therefore electrical isolation is made between the output stage of a control amp and the pre-driver circuit of this amplifier to eliminate interference between both circuits. Thus stable amplification with low distortion is attained.

Pre-Driver Circuit

Signals converted into low impedance at emitter follower circuit are then fed to the two-stage differential amplifier, a kind of balanced DC amplifying circuit, to meet voltage amplification. The differential amplifier is always stable against the fluctuation of mains voltage and temperature drift, and has been adopted widely in computors or measurement instruments etc. by means of IC's as Operational Amplifier.

The two transistors Q301, Q302 for the 1st stage differential amplifier are arranged quite symmetrically, and the emitter of the both transistors are connected to (+) power supply through a common resistor. The base of Q301 accepts the input signal, while that of Q302 accepts the feed back signal. Due to adoption of two transistors of the same characteristic, equivalent collector current and emitter current are available when the same signals are fed to the base of the both transistors. As emitter current for two pieces of resistors will flow through the emitter resistor, the emitter potential will rise up, which corresponds to the amount of negative feedback. On the other hand, if subtle (+) potential may appear at the speaker terminal by the drift of transistors caused by other factors but signals, e.g., the raise up of temperature, this (+) potential is led to the base of Q302 via the feedback circuit, when (+) signal of the same phase will appear at the emitter resistor. In this case, the potential at the emitter resistor varies to (+), which reduces the collector current to have (-) potential at collector. The voltage is amplified by the 2nd differential amplifier Q303, Q304, which makes the (+) potential stable at the speaker terminals, and helps keep balanced 0 potential.

The 2nd differential amplifier operates same as the 1st one, though not perfectly symmetrical. The constant current driven by Q305 is applied, since this stage aims at voltage amplification. The emitter follower circuit is arranged annexed to the differential amplifier with a pair of Q306 and Q307 which electrically isolates the "Class A" operation at the differential stage and the "Class B" operation at the power amp stage. (Q306 is for the emitter follower and Q307 is for its constant current driving.). Therefore, impedance fluctuation caused by the speaker loads would not affect the pre-driver stage. With this pre-driver circuit, stable driving with low distortion is feasible up to high frequency range with a slighter phase compensation comparing with conventional high power amplifiers.

As for the power supply circuit for the "Class A" operation sections up to the differential stage, a real automatic voltage regulator is adopted to avoid bad influence which may possibly be caused by the fluctuation of AC mains voltage or the current fluctuation in the power amplifier section.

Power Output Circuit

Adopted is a pure complementary push-pull circuit composed by the power transistors of NPN group and PNP group which are all specially developed for LUXMAN. In order to produce such a high power of 300W/ch, two parallel triple push-pull stages utilizing 12 power transistors designed for high power output are arranged at the final stage. And the parallel push-pull stage utilizing

4 driver transistors which are also exclusive for LUXMAN is arranged at the complementary driver stage. Thus sufficient driving of various type of the speaker systems is feasible.

With the M-6000 the total collector-dissipation of the power transistors in each channel is 900W, and the collector emitter breakdown voltage is 200V. The parallel push-pull connection is also adopted at the complementary driver stage, and therefore the distortion characteristic is improved just in the same way as the final stage.

The power supply for the final stage and the complementary driver stage is quite independent for the left channel and right channel, which ensures the same power output at each channel whether both channels are driven or single channel is driven. But bear in mind that when the full power output is fed into 4-ohm loads, a slight difference may be possible due to the regulation of the commercial electric power.

Bias Circuit

The adjustment of the quiescent current at the final stage is made by a thermal diode and the transistor Q113. These components directly touch the heat sink, and compensates the excesssive heat and the temperature drift.

Protection Circuit

The OCL circuit, in which the speaker system is directly connected to the amplifier, is ideal in the point that the input signal is delivered most faithfully. But this circuit is always accompanied by the danger that any abnormal factors aroused in the amplifier will be delivered to the speaker system without barrier. On the other hand, electronic components will increase in number in proportion with improvements of the circuit design, and it is hard to foresee every trouble that may happen, even if the most severe selection is made for the superior components. Necessity is here to have the protection circuits.

The most important in the operation of the protection circuitry is reliability and speed. Therefore the sensitivity should be as high as possible in the range of the safety operation. The protection circuits of the M-6000 have to be designed not to be mis-functioned by the current of music reproduction signal. The block diagram will help you understand the outline of the protection circuits.

For the over-current sensing, the conventional one-point detection of the abnormal current will tend to induce mis-operation. With the M-6000, when two contradictory current conditions are sensed by the comparator, this sensing circuit operates and shuts off the mains power, for example, short-circuited at output - no output signal and a heavy DC current are sensed at the same time. Further, in order to attain more safety, when excessive current, which may break the power transistors, appears, the current is once restrained electronically to keep the operation of the power transistors in the S.O.A. (Safe Operation Area). And in case the restraint time lasts over the certain time, the mains power is shut off by an S.C.R. (Silicon Controlled Rectifier).

Other protection circuits are:

#D.C.-Drift Sensing --- This protects the speaker system by cutting off the output when some $\pm$3V is detected at the speaker terminals. This also operates as the muting circuit which safeguards the speaker system from transient phenomena caused by the mains being turned on.

#Power Transistor Failure Sensing --- This shuts off the mains power when even one fuse of any power transistors is ruptured.

#Abnormal High Temperature Sensing --- This shuts off the mains power when the temperature at the heat sink exceeds 100°C under hard driving for a long time.

Thus the M-6000 is equipped with 4 protection circuits. One is for protection of speaker systems, and the other three are for protection of the amplifier.

V.U. Meter & Peak Indication Circuit

The purpose of the V.U. meter originally was just to show the reproduced signal visually, but today peak meters of high attack-speed and slow recovery etc. have been adopted to display the precise signal level. But the mechanical meters have difficulty to indicate accurately the pulse signals which are usually contained in the musical signals. In this sense the electronic display method is necessary.

Thus the M-6000 is equipped with electronic peak indicator together with the mechanical V.U. meter to make it easy to visually compare the difference between the average level and the peak level. Further ON-OFF switches are available for the operation of the both indicators.

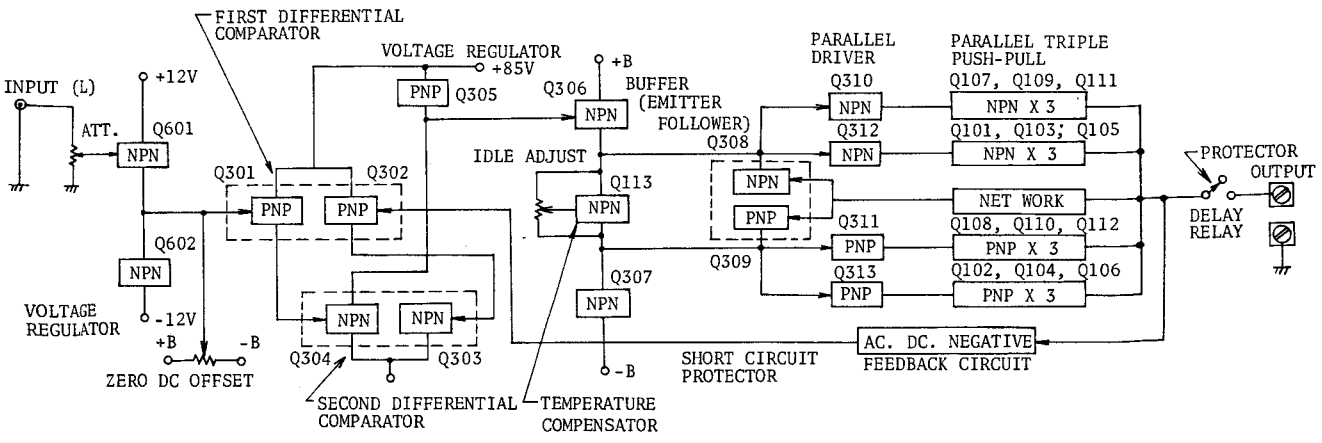
V.U. meter amp circuit, unlike the ordinary V.U. meters in which the needle is directly moved by the detection of signal current, adopts 2 transistors, and the meter is inserted in the NF loop of the meter amp circuit and is driven by constant current. Therefore the scale is made linear and easy-reading is attained.

In the peak indication circuit , after the output signal is detected, the signals flow into the differential Schumitt Circuitry, on which the voltage equivalent to the standard level is given, with a certain retaining time of the peak level, and the indication is made according to the standard level. For the peak indication, Light Emitting Diodes are adopted, which ensures high speed response against the pulsive input signals.

Power Output

The power supply for the output stage of two parallel triple push-pull stage utilizes independent 2 power supplies by adopting separate power transformers for the right channel and the left channel. Therefore, the power output of 300W per channel into 8-ohm loads, 500W per channel into 4-ohm loads is possible.

MODEL: M-6000 BLOCK DIAGRAM



A L I G N M E N T P R O C E D U R E

1) Pilot lamp does not light up.

1. Protector Indicator lights up.

   Causes: Power transistor (TO-3 or TO-66) in the Final stage and Driver stage of Class AB operation may be damaged.

   Measures:

   a) Check whether the damaged TR is in Left channel or Right channel. For this check, remove the 2 fuses on one channel (right or left), and power switch should be at "on". By this procedure, when the pilot lamp lights up normally, the channel where the 2 fuses remain is free from failure. When the 2 fuses are inserted to the other channel, and if the PROTECTOR LAMP lights, the TR in this channel is damaged.

   b) Remove the screws fixing the heat sink of the damaged channel. And remove this heat sink together with the power transistor (TO-3) block carefully from the main chassis. Then remove the fuse on the printed circuit board PB-680A or PB-681A, and check each transistor if short circuit might happen. Replace when damaged.
   [Firstly remove plate-like heat sink block with flat-bladed driver through the round hole available at the side of printed circuit board. Then remove the TR fixing screws at the side of heat sink.]

   N.B.
   As for PB-680/PB-681, 12 power transistors (TO-3) are mounted on one board. 6 transistors of NPN type are arranged at the outer side and 6 transistors of PNP type at the inner side, in the fixed state of the each printed circuit board.

   When replacement of the power transistor is finished, all the fuses removed should be set as they were.
   Reconstruction procedure may simply be done in the reverse order. But bear in mind that the connector of the printed circuit board is flexible to obtain clearance, therefore ascertain that the connector contacts the chassis, by pressing the connector toward the board from the bottom of the chassis after the heat sink is mounted.

   Now the procedure at Final stage has been finished.

   Transistor (TO-66) check at Driver Stage

   The printed circuit boards are PB-682A and PB-683A located in front of the PCB of final stage. Transistors are Q410, Q412 or Q310, Q312 for NPN type and Q411, Q413 or Q311, Q313 for PNP type, all of which are located in the vicinity of the fuse; outer ones (bottom) are NPN and center one are PNP.

   Now all the check for the power transistors of Class AB has been finished. But the following further procedure is advisable before the power switch ON to prevent the breakage caused by omission of each check procedure.

   1) Set a DC amperemeter between the No1 and No2 terminals of 4P terminal block at the back of the chassis. The current flows from the inner terminal toward the outer one.
   2) Remove the short-circuited material connected between No1 and No2 as well as NO3 and NO4, by this, quiescent current may be measured.
   3) Provisionally short-circuit the terminals of the Power Relays respectively with a certain clip or something like that.
   4) Gradually increase the AC primary voltage.

5) When the swing of the Amperemeter falls abruptly near 1A and no more increase could be confirmed, each transistor is operating without failure.

CAUTION: Never try to turn on the power switch with the block of the Final stage kept removed, for instance, with only the PCB of Driver stage mounted. This may break the Driver transistors because the transistor for temperature compensation is on the PCB of Final stage. Therefore when this is disconnected the bias voltage between Base and Base of Driver TR becomes over-rated.

By this check procedure, when the quiescent current is found abnormally increased, short circuit between collector and emitter of the TR for bias compensation. If the amperage would decrease, the failure may be caused by this TR, and not the other TRs. In this occasion, treatment should be done in the same manner as the replacement of the components at Final stage. The collector and the emitter of this TR are connected to (J) and (L) terminal respectively of the center connector in the connector of the board for Final stage.

N.B.

In case (+) power and (-) power are not supplied at the same time (only for Class AB of Final stage), the Protector lamp will light up. Therefore bear it in mind not to forget that the short-circuited material removed should be soldered as it were after measuring quiescent current etc. is finished. Also note that the Protector lamp may light up when the fuse on the board for protection purpose is detached.

Pre-Driver Stage

In case the supply voltage of ±85V is not supplied, failure of Driver PCB(PB-682, PB-683) may be suspected. Remove the Driver PCB and check the voltage again. When the rated voltage is not confirmed, transistors etc. on PB-684A may be damaged.

2. Protector Indicator does not light up.

a) Check the voltage at one end of the emitter-resistor (22-ohms) of Q700 and Q701 at AVR section on PB-687A. This is adjusted at 22.5V. When it is different, adjust the collector voltage of this TR, and confirm if the input voltage is available. In case this voltage is normal, check whether the AC switching relay on left channel is switched ----- if the relay operated, left channel is all right.
When left channel operates normally, right channel may be suspected which operates time-delayed. Check Q713 or Q714.

b) When AC relay on left channel is damaged by mal-contact etc, pre-driver voltage will not be supplied to right channel, therefore both channels will not operate.

c) When the muting Relay is damaged, signals will not be available at speaker terminals. In this case, TR's of Q724, Q725 or Q726 may be broken.

3. L.E.D. Indicator or the Swing of V.U. Meter operates abnormally.

These equipments as L.E.D. Indicator or V.U. Meter may be removed by losing the screws on the sub-panel after removing the attenuator knob. Inside the sub-panel housed are the printed circuit boards, namely, PB-688A, PB-689A, PB-690, PB-686A, PB-691A and PB-692A. These printed circuit boards operate as follows:

PB-686A ----- This is an input amplifier and adjust input signals for ATTENUATOR. Emitter-follower circuit is adopted. Gain: 1.

PB-689A ----- Amplifier for the Peak Indicator. As input level varies, so do the printed circuit boards. This means that one PCB of the same name is prepared for an L.E.D. Totally 8 boards are used to operate the whole L.E.D. Peak Indicator. Each board is of interchangeable type, and when found any mal-

function substitute each other. In case lighted-up level found to be varied, check the PCB.

PB-690 ----- This accomodates the Flip-Flop circuit for STAND-BY, First stage amp for L.E.D.

PB-688A---- This is equipped with sockets for level amp for the V.U. Meter and PB-689A.

PB-691A---- This divides the speaker signal by use of the relay and the precision resistors.

PB-692A---- Each push-switch is mounted on this board. At "VU-PEAK" position, the relay on PB-691A will be operated at the same time.

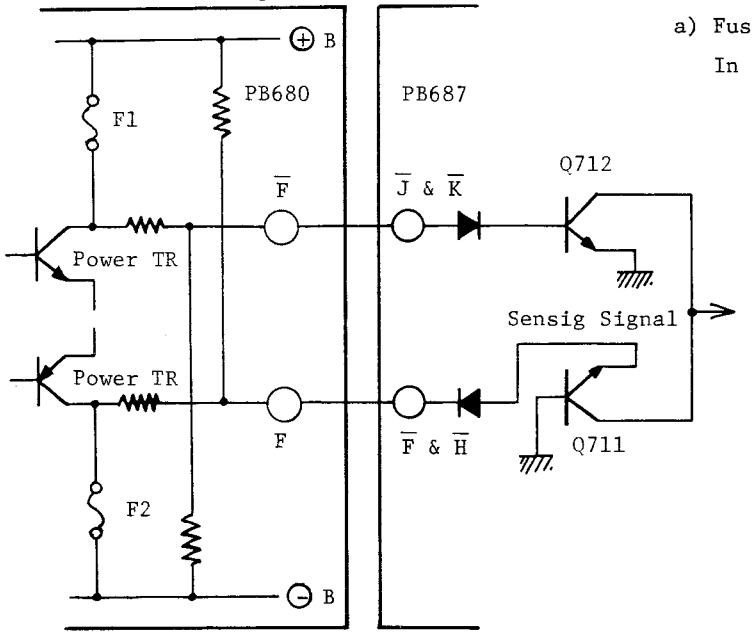
2) Operation of Power Supply Source

Manual turn-on of the power switch (A) makes the constant voltage section for protector operate, which operates each sensing section and at the same time the power switch (B) for the main amp is turned on, and the entire amplifier is put into operational condition. Then the speaker relay (C) is turned on to connect the circuit to speakers after some 5 seconds unless any trouble is detected at each sensing circuit.

In case some troubles are detected in the amplifier to operate any of the sensing circuits 1 - 3, the realy (B) provided at the primary side of the power transformer is instantly turned off to shut off the power supply to the entire amplifier, and the L.E.D. for protector indication lights up. (manual recovery)

When abnormal drift appears at the speaker terminals, the DC-drift sensing circuit is operated to cut off the speakers on load, and the Muting L.E.D. is made blinking continuously. In this case, however, the protector L.E.D. does not light up since the mains power supply is not shut off. (automatic recovery)

a) Fuse-blown Sensing for Power Transistor



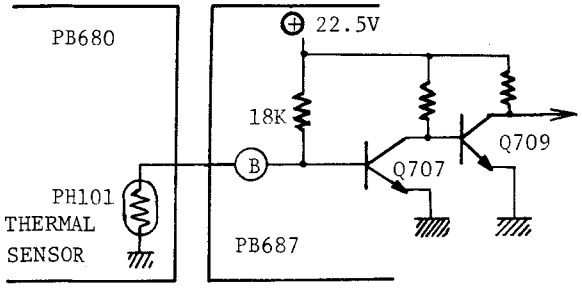
3) Operation of Each Sensing Section

a) Fuse-blown Sensing for Power Transistor

In case the fuse 5A provided to each power transistor is normal, (+) potential is appears at the (k̄)(J̄) terminal on PB-687, while (-) potential at the (F̄)(H̄) terminal. Therefore Q711 and Q712 are not turned on, and sensing signal is not generated.

If the fuse F1 for NPN power transistor is blown off, (-) potential appears at the (k̄)(J̄) terminal, which turns Q712 on. Also when the F2 for PNP power transistor is blown off, (+) potential appears at the (F̄)(H̄) terminal, which turns Q711 on. Thus in these cases sensing signal is generated.

b) Thermal Sensing on the Heat Sink



b) Thermal sensing on the Heat Sink

In case the temperature of the heat sink is below 100°C, Q707 is OFF and Q709 is ON since PH101 has sufficiently low resistance, therefore sensing signal is not available.

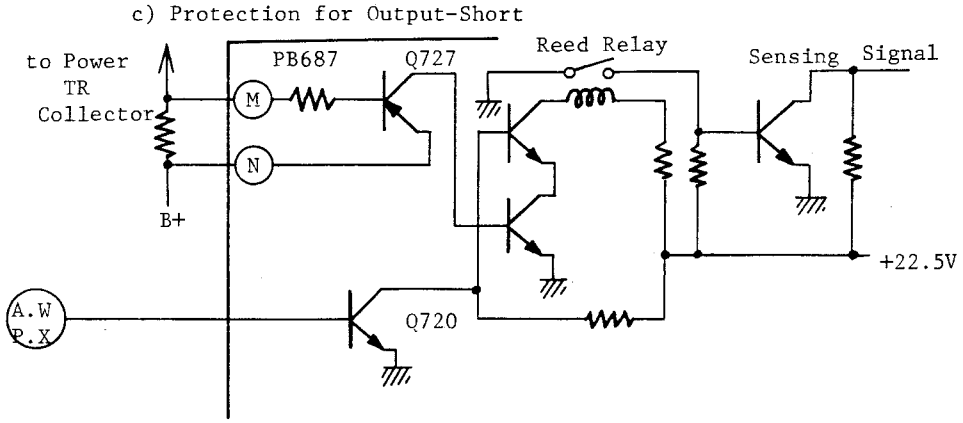
But when it exceeds 100°C, the PH101 is turned to be of high resistance, which makes Q707 to be ON, and Q709 to be off, and incidentally the sensing signal is generated.

c) Protection for Output-Short

Q727 repeats ON and OFF in accordance with the collector current of the power transistor. Q720 is ON only when the output signal is available at the amplifier output.

Both Q730 and Q731 compare these two states, and generate sensing signal only when large current appears without any music signal at the output terminals. The sensing signal is not generated by such large current as music signals.

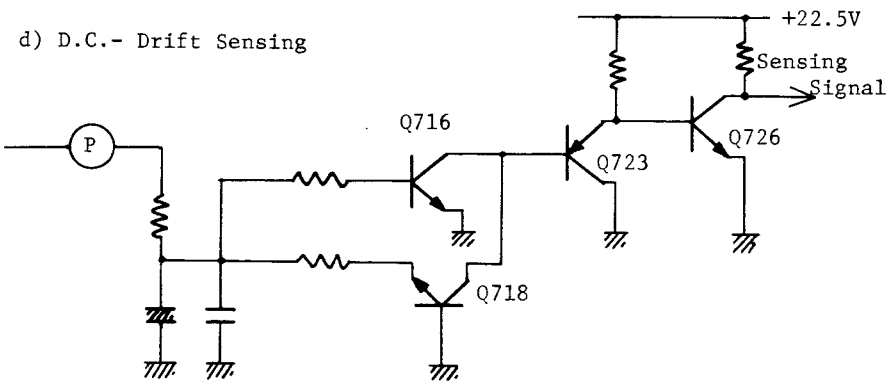
c) Protection for Output-Short

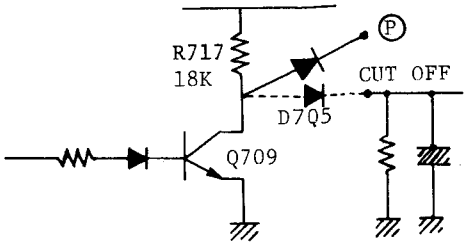


d) DC-Drift Sensing

When the DC-drift appeared at the point P is (+), Q716 is turned ON, while in case the potential is (-), Q718 is turned ON, which turns Q726 OFF. Further +22.5V is generated as the sensing signals.

d) D.C.- Drift Sensing





Protector L.E.D. lights up instantaneously at the time of turning the power switch on.

When PB687 is replaced, normal operation is obtained.

YES → Something wrong with the Amp. Refer to No. 2.

NO

Remove one end of D705 on PB687 (Regard it as the point Ⓟ) Some +22V is available at Ⓟ . (See the chart above.)

NO → Replace them and then adjust VR700 so as to get +22.5V at the Ⓛ terminal. (Ⓛ terminal is the Ⓛ of 12P connector on PB687.)

YES

When Q705 on PB687 is removed, +22V is available at Ⓟ .

YES → Defective on Q700 - Q703 or on SCR (A - K short-circuited)

NO

+22V is available at Ⓟ when Q710 is removed with placing Q705 again.

NO → C - E short-circuited on Q706 - Q708 or C - E open-circuited on Q709.

YES

+22V is available at Ⓟ even when R756 (jumper) on PB687 is cut off.

NO → C - E short-circuited on Q710 - Q712.

YES

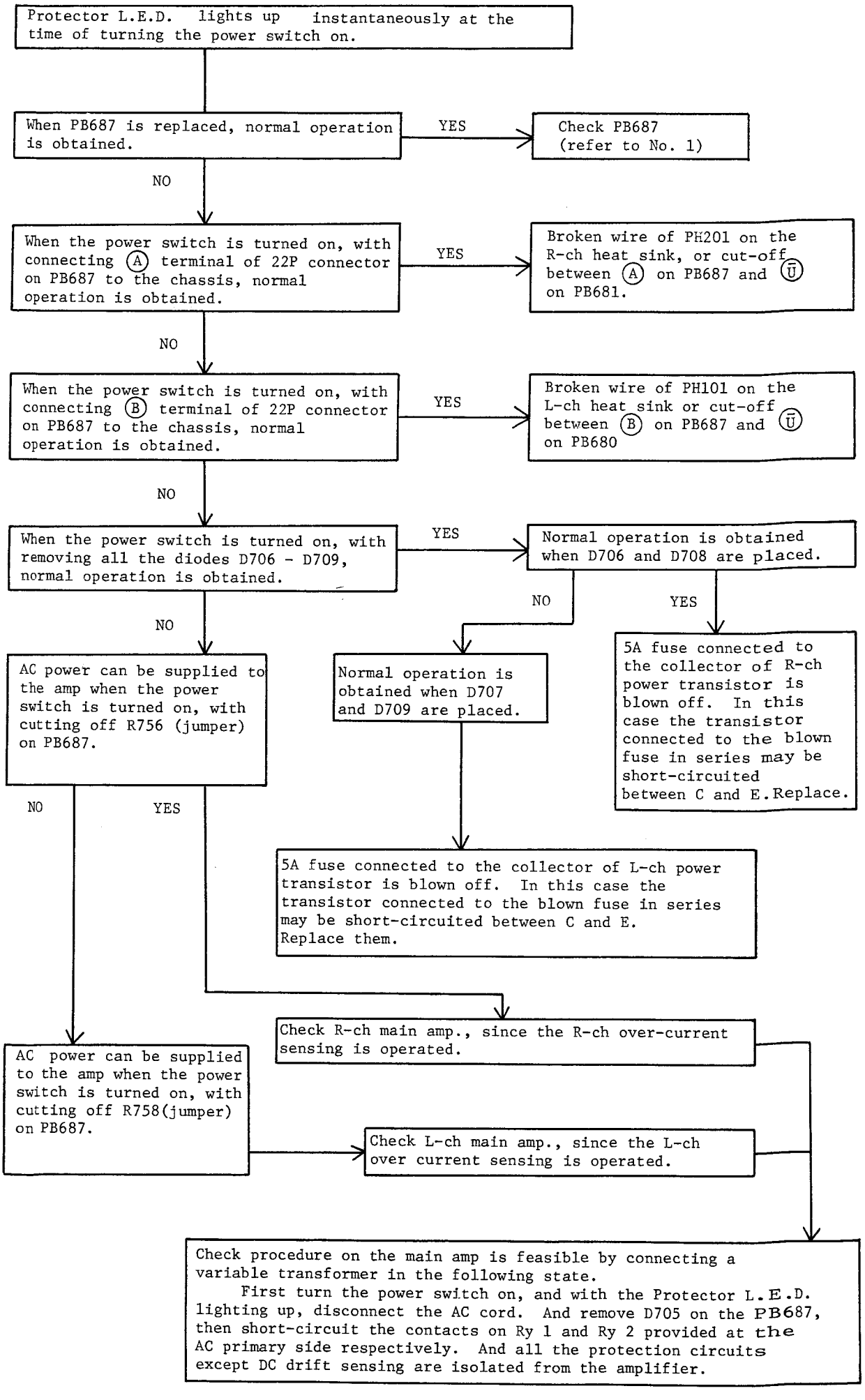
+22V is available at Ⓟ even when R758 (jumper) on PB687 is cut off.

NO → C - E short-circuited both on Q729 and Q732.

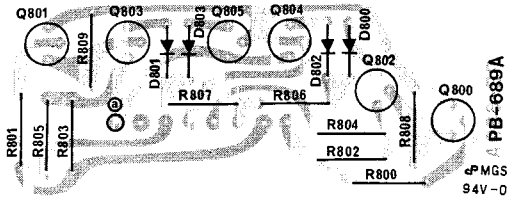
YES

C - E of Q704 open-circuited or broken wire of D701.

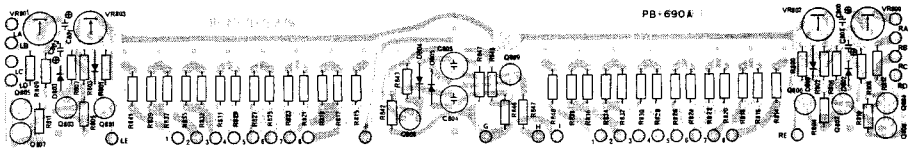
C - E short-circuited both on Q730 and Q731.


Protector L.E.D. lights up instantaneously at the time of turning the power switch on.
When PB687 is replaced, normal operation is obtained.
YES
Check PB687 (refer to No. 1)
NO
When the power switch is turned on, with connecting (A) terminal of 22P connector on PB687 to the chassis, normal operation is obtained.
YES
Broken wire of PH201 on the R-ch heat sink, or cut-off between (A) on PB687 and (Ū) on PB681.
NO
When the power switch is turned on, with connecting (B) terminal of 22P connector on PB687 to the chassis, normal operation is obtained.
YES
Broken wire of PH101 on the L-ch heat sink or cut-off between (B) on PB687 and (Ū) on PB680
NO
When the power switch is turned on, with removing all the diodes D706 - D709, normal operation is obtained.
YES
Normal operation is obtained when D706 and D708 are placed.
NO
YES
NO
AC power can be supplied to the amp when the power switch is turned on, with cutting off R756 (jumper) on PB687.
Normal operation is obtained when D707 and D709 are placed.
5A fuse connected to the collector of R-ch power transistor is blown off. In this case the transistor connected to the blown fuse in series may be short-circuited between C and E. Replace.
NO
YES
5A fuse connected to the collector of L-ch power transistor is blown off. In this case the transistor connected to the blown fuse in series may be short-circuited between C and E. Replace them.
Check R-ch main amp., since the R-ch over-current sensing is operated.
AC power can be supplied to the amp when the power switch is turned on, with cutting off R758(jumper) on PB687.
Check L-ch main amp., since the L-ch over current sensing is operated.
Check procedure on the main amp is feasible by connecting a variable transformer in the following state.
First turn the power switch on, and with the Protector L.E.D. lighting up, disconnect the AC cord. And remove D705 on the PB687, then short-circuit the contacts on Ry 1 and Ry 2 provided at the AC primary side respectively. And all the protection circuits except DC drift sensing are isolated from the amplifier.

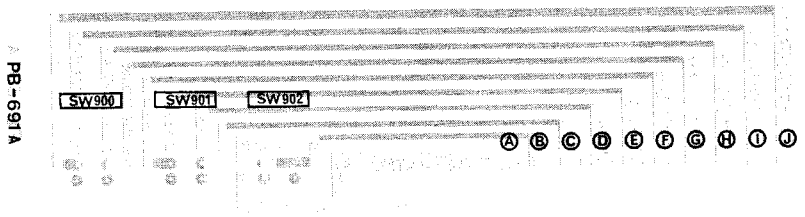
PB689A



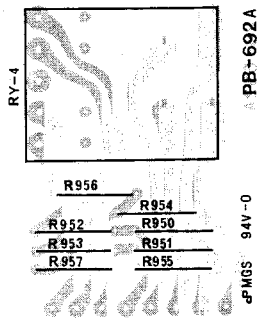
PB690A



PB691A



PB692A



REPLACEMENT PARTS

PB-680A

SYMBOL NO.			LOCATION
R101	10	1W	X-B
102	2.2K	1/2W	X-B
103	0.47	5W	X-B
104	0.47	5W	X-D
105	2.2K	1/2W	X-D
106	10	1W	X-D
107	330K	1/2W	X-B
108	10	1W	Y-B
109	2.2K	1/2W	X-B
110	0.47	5W	X-B
111	0.47	5W	X-D
112	2.2K	1/2W	X-D
113	10	1W	Y-D
114	330K	1/2W	X-D
115	330K	1/2W	X-B
116	10	1W	Y-B
117	2.2K	1/2W	Y-B
118	0.47	5W	Y-B
119	0.47	5W	Y-D
120	2.2K	1/2W	Y-D
121	10	1W	Y-D
122	330K	1/2W	X-D
R123	330K	1/2W	Y-B
124	10	1W	X-A
125	2.2K	1/2W	X-A
126	0.47	5W	X-A
127	0.47	5W	X-C
128	2.2K	1/2W	X-C
129	10	1W	X-C
130	330	1/2W	X-D
131	330	1/2W	X-A
132	10	1W	Y-A
133	2.2K	1/2W	X-A
134	0.47	5W	X-A
135	0.47	5W	X-C
136	2.2K	1/2W	X-C
137	10	1W	Y-C
138	330K	1/2W	X-C
139	330K	1/2W	X-A
140	10	1W	Y-A
141	2.2K	1/2W	Y-A
142	0.47	5W	Y-A
143	0.47	5W	Y-C
144	2.2K	1/2W	Y-C
R145	10	1W	Y-C
146	330K	1/2W	Y-C
147	330K	1/2W	Y-A
148	56K	1W	X-C
149	56K	1W	X-B
150	330K	1/2W	Y-C
Q101	2SD424-R, O		X-B
102	2SB554-R, O		X-D
103	2SD424-R, O		X-B
104	2SB554-R, O		X-D
105	2SD424-R, O		Y-B
106	2SB554-R, O		Y-D
107	2SD424-R, O		X-A
108	2SB554-R, O		X-C
109	2SD424-R, O		X-A
110	2SB554-R, O		X-C
111	2SD424-R, O		Y-A
112	2SB554-R, O		Y-C
113	2SC1745-BL		Y-C
PH101	487A01BD471TS		Y-B

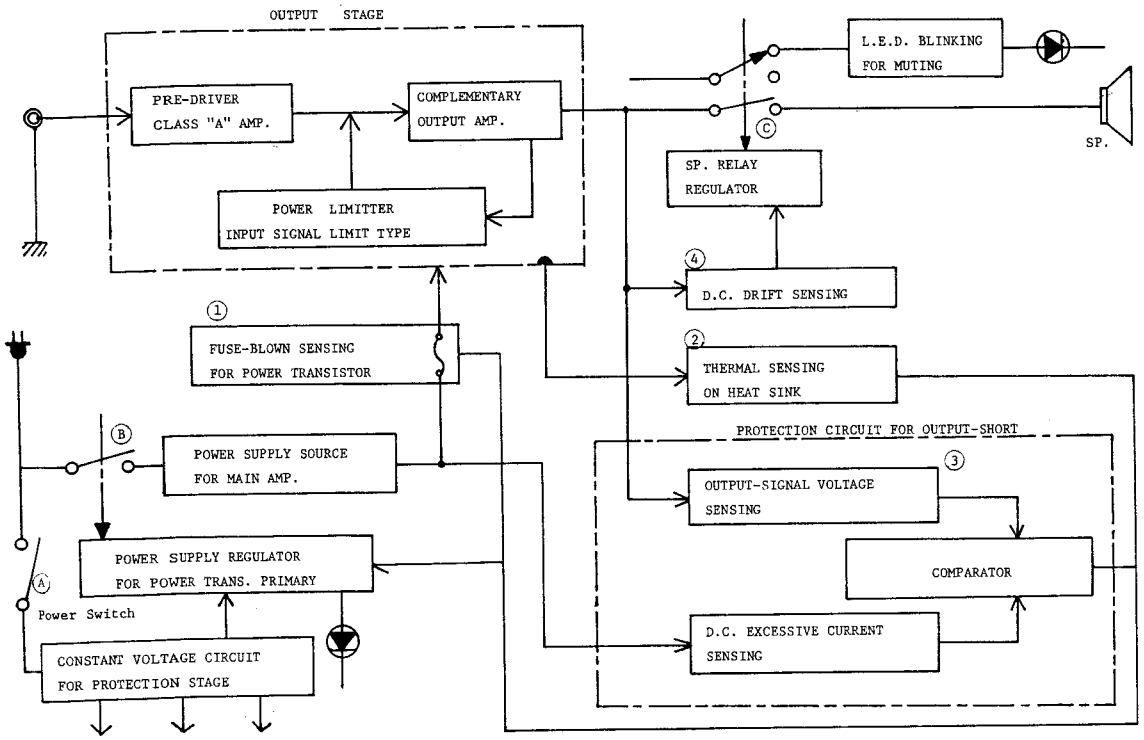
PB-681A

SYMBOL NO.			LOCATION
R201	10	1W	X-D
202	2.2K	1/2W	X-D
203	0.47	5W	X-D
204	0.47	5W	X-B
205	2.2K	1/2W	X-B
206	10	1W	X-B
207	330K	1/2W	X-D
208	10	1W	Y-D
209	2.2K	1/2W	X-D
210	0.47	5W	X-D
211	0.47	5W	X-B
212	2.2K	1/2W	X-B
213	10	1W	Y-B
214	330K	1/2W	X-B
215	330K	1/2W	X-D
216	10	1W	Y-D
217	2.2K	1/2W	Y-D
218	0.47	5W	Y-D
219	0.47	5W	Y-B
220	2.2K	1/2W	Y-B
221	10	1W	Y-B
222	330K	1/2W	X-B
223	330K	1/2W	X-D
R224	10	1W	X-C
225	2.2K	1/2W	X-C
226	0.47	5W	X-C
227	0.47	5W	X-A
228	2.2K	1/2W	X-A
229	10	1W	X-A
230	330K	1/2W	Y-B
231	330K	1/2W	X-C
232	10	1W	Y-C
233	2.2K	1/2W	X-C
234	0.47	5W	X-C
235	0.47	5W	X-A
236	2.2K	1/2W	X-A
237	10	1W	Y-A
238	330K	1/2W	X-A
239	330K	1/2W	Y-C
240	10	1W	Y-C
241	2.2K	1/2W	Y-C
242	0.47	5W	Y-C
243	0.47	5W	Y-A
244	2.2K	1/2W	Y-A
245	10	1W	Y-A
246	330K	1/2W	X-A
R247	330K	1/2W	Y-C
248	56K	1W	X-B
249	56K	1W	X-C
250	330K	1/2W	X-C
Q201	2SD424-R, O		X-D
202	2SB554-R, O		X-B
203	2SD424-R, O		X-D
204	2SB554-R, O		X-B
205	2SD424-R, O		Y-D
206	2SB554-R, O		Y-B
207	2SD424-R, O		X-C
208	2SB554-R, O		X-A
209	2SD424-R, O		X-C
210	2SB554-R, O		X-A
211	2SD424-R, O		Y-C
212	2SB554-R, O		Y-A
213	2SC1745-BL		Y-B
PH201	487A01BD471TS		Y-C

PB-682A

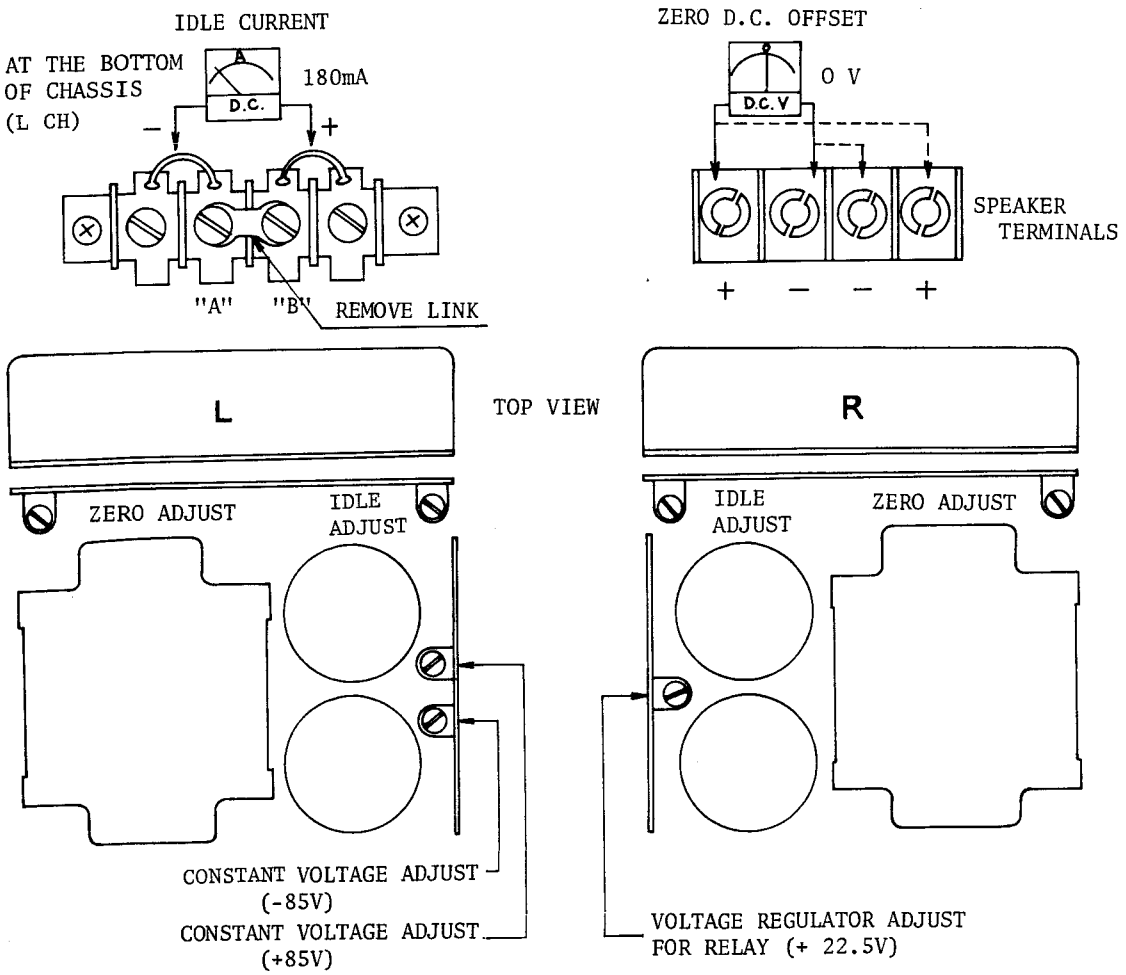
SYMBOL NO.			LOCATION
R301	4.7K	1/4W	Y-A
302	47	1/2W	Y-A
303	330	1/2W	Y-A
304	33K	1W	Y-A
305	330	1/2W	Y-A
306	56K	1/2W	Y-A
307	33K	1W	X-A
308	3.9K	1/2W	X-A
309	10K	1W	Y-A
310	8.2K	1/2W	Y-A
R311	3.9K	1/2W	X-A
312	1.2K	1/2W	Y-A
313	56K	1/2W	Y-A
314	220	1/2W	X-A
315	220	1/2W	Y-B
317	82K	1/2W	X-B
318	47	1W	Y-C
319	100K	1/2W	Y-B
321	100	2W	Y-C
322	270	1/2W	X-C
R324	22	2W	Y-B
325	15	1/2W	X-C
326	330	1/2W	Y-B
327	330	1/2W	Y-C
328	47	1/2W	Y-B
329	47	1/2W	Y-B
330	3.3K	1/2W	Y-B
331	100	1W	Y-A
332	3.3K	1/2W	Y-B
333	100	1W	Y-C

B L O C K D I A G R A M (PROTECTION)

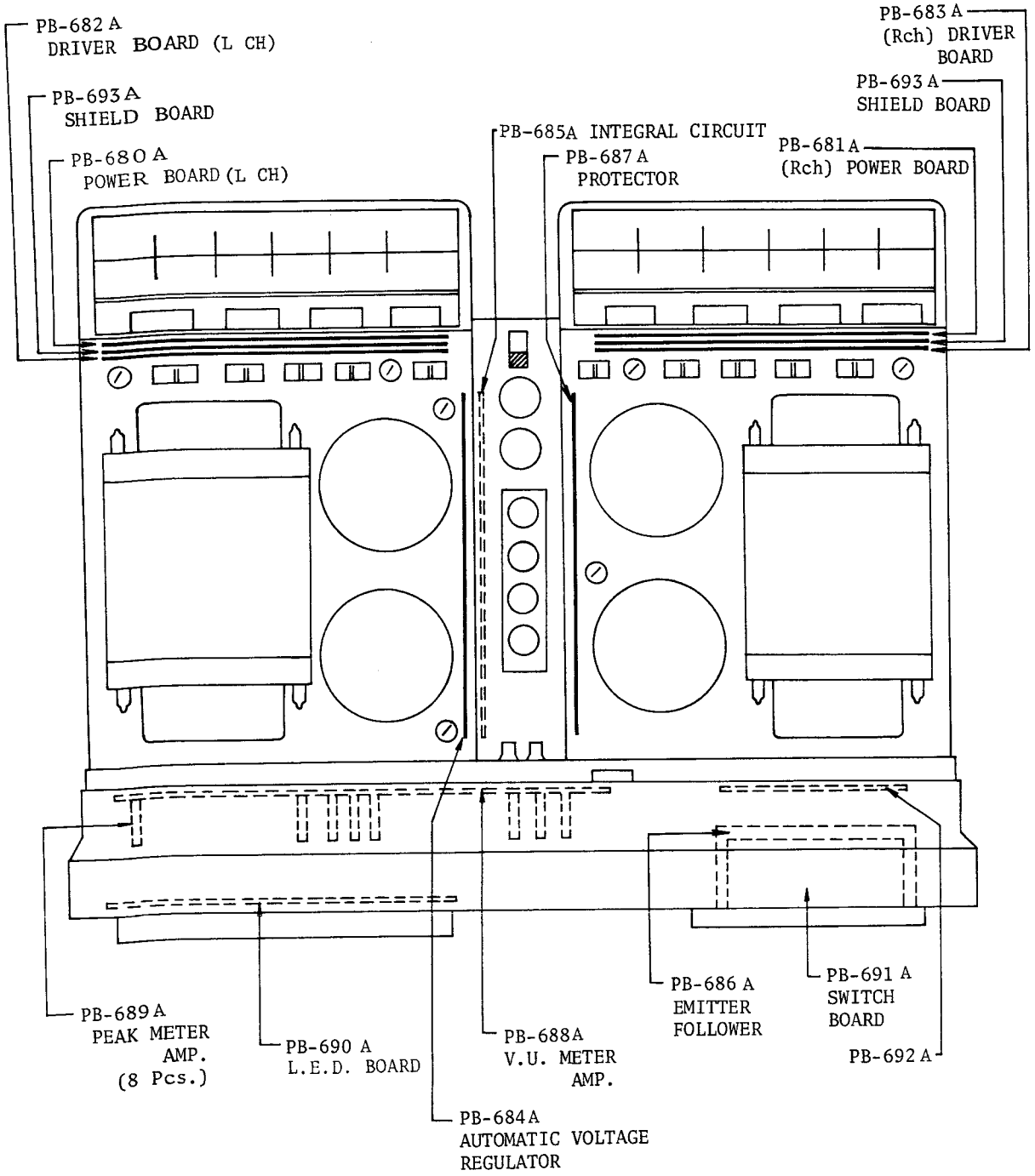


IDLE CURRENT AND ZERO D.C. OFFSET

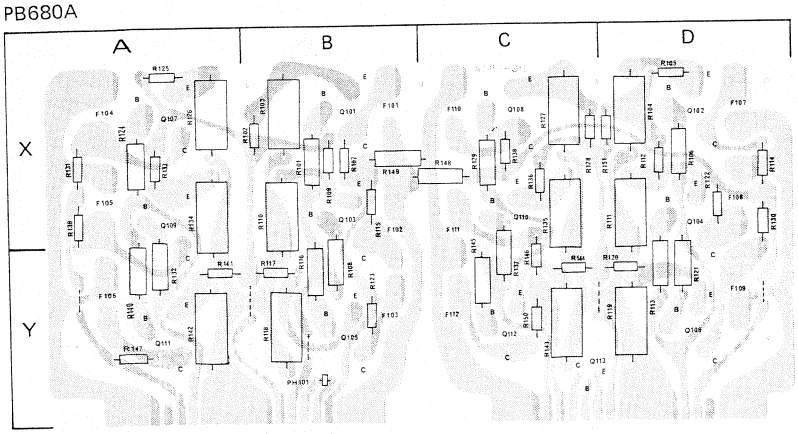
CAUTION: Set level controls to ∞ position
1) Do not operate with no "Amp meter" or "Link" connected across points "A & B".
2: Final adjustment of the idle current should be set after 30 minutes of operation.



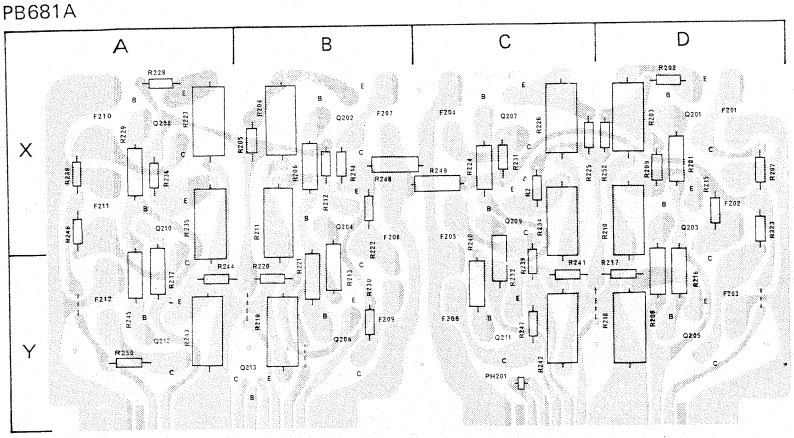
P.B. LOCATION


PB-682 A
DRIVER BOARD (L CH)
PB-693 A
SHIELD BOARD
PB-680 A
POWER BOARD (L CH)
PB-685A INTEGRAL CIRCUIT
PB-687 A
PROTECTOR
PB-683 A
(Rch) DRIVER
BOARD
PB-693 A
SHIELD BOARD
PB-681 A
(Rch) POWER BOARD
PB-689 A
PEAK METER
AMP.
(8 Pcs.)
PB-690 A
L.E.D. BOARD
PB-684A
AUTOMATIC VOLTAGE
REGULATOR
PB-688A
V.U. METER
AMP.
PB-686 A
EMITTER
FOLLOWER
PB-691 A
SWITCH
BOARD
PB-692 A

PB680A



PB681A



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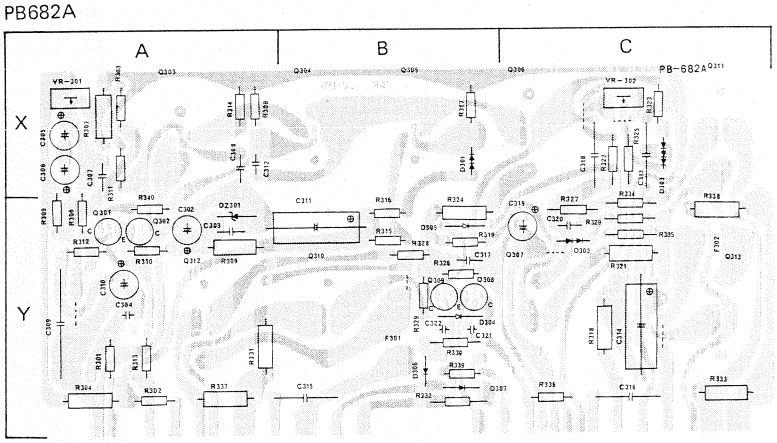
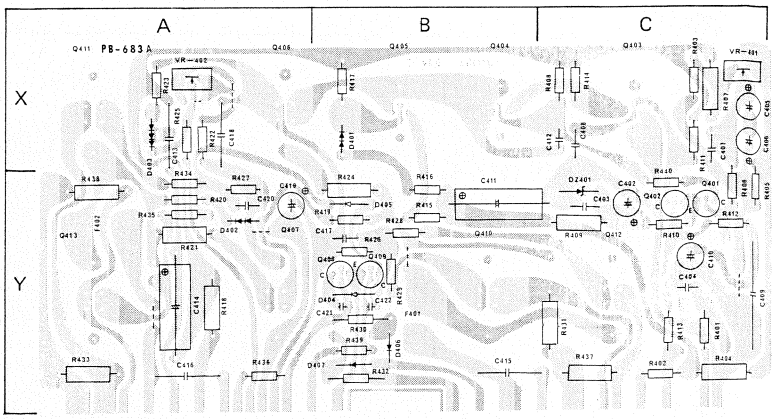


PB683A



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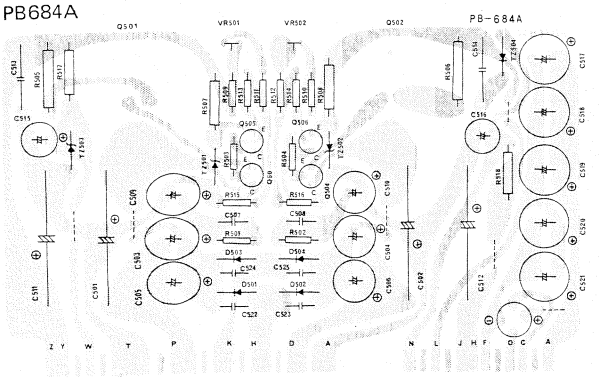
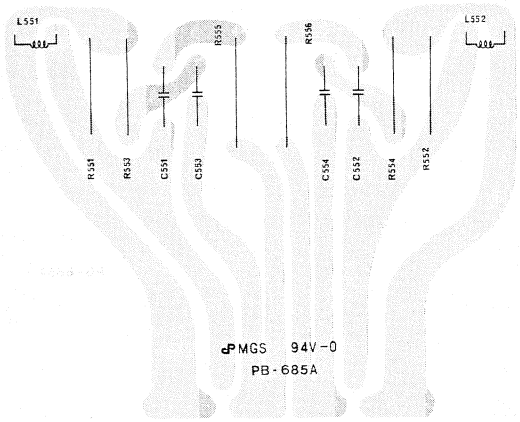
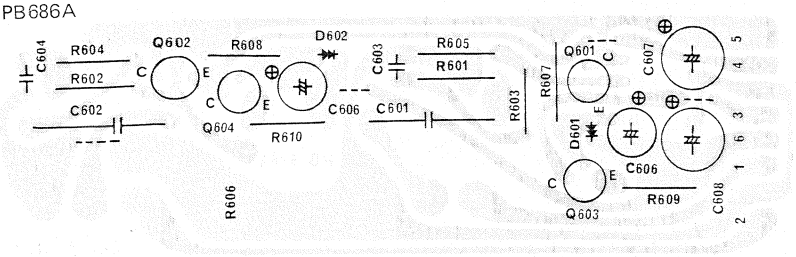


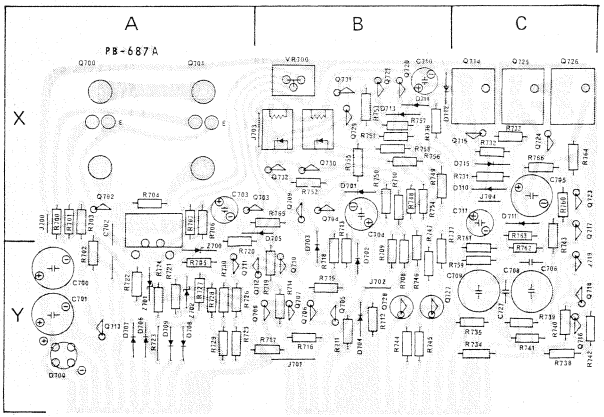
PB685A



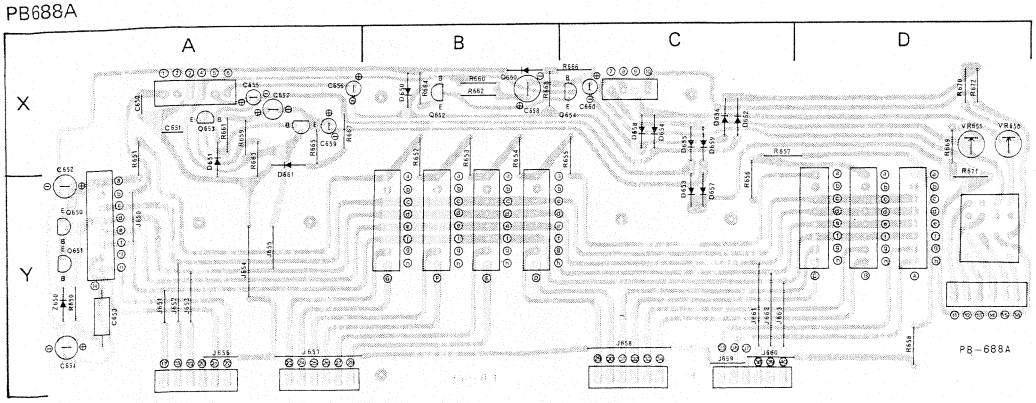
PB686A



PB687A



PB688A



This servicing section should be applied to the models with the serial No. up to Serial No.A6100317.

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Referring to Power Transistor Breakage

CAUSE: Durability of the transistors manufactured by N.E.C. is found relatively poor as compared with these manufactured by TOSHIBA, and incidentally they may be damaged before the protector is operated. And further the protector does not happen to operate on a certain level of the output and an a certain frequency.

COUNTER-MEASURE: # The poor transistors should be changed from N.E.C. to TOSHIBA brand.

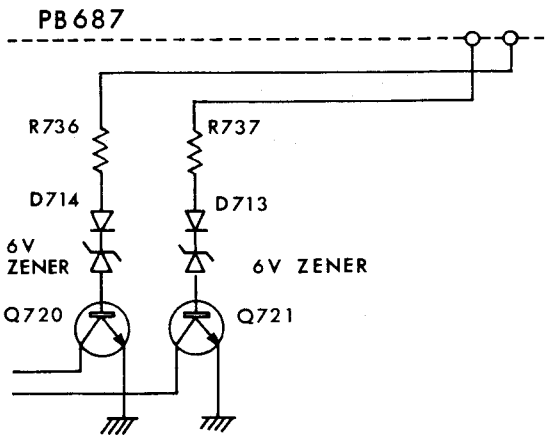
To expand the operational range of the protector circuit, and at the same time to let it operate more speedily.

MODIFICATION: 1) All power transistors should be changed into TOSHIBA.

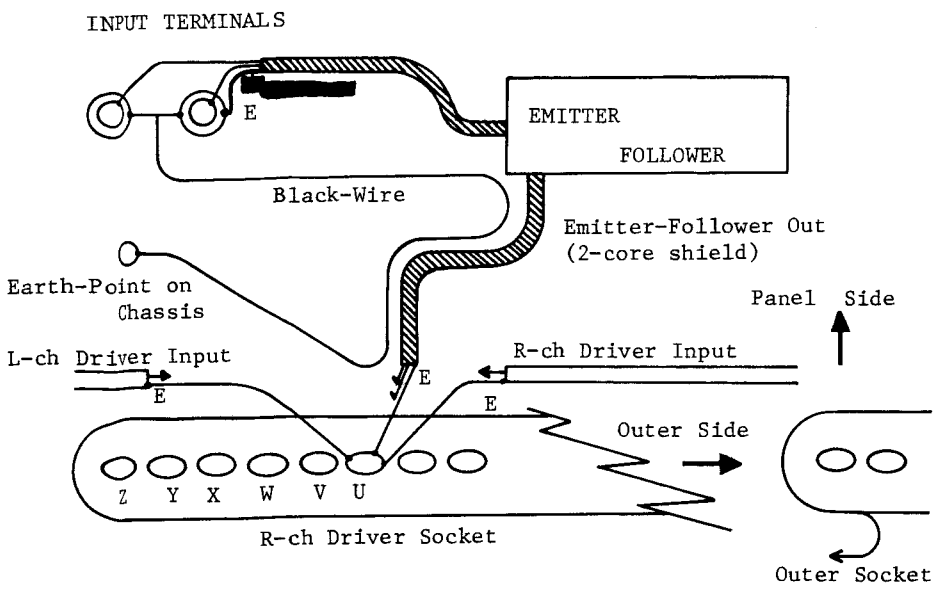
2) A 6V zener diode should be added in between the base of Q720 and the existing diode D714, and the same zener in between the base of Q721 and D713. (To expand the operational range of the protector versus output level.)

3) An electrolytic of 100uF 10V should be added in parallel with the coil of the reed-relay on PB687. (A reed-relay is adopted instead of the photo-coupler in the models for the U.S.A. market.) (To expand the operational range of the protector versus output frequency.)

4) An electrolytic of 4.7uF 10V should be adopted for C704 on PB687. (To obtain shorter operational time of the protector.)



Counter-measure against the trouble of the anti-oscillation resistor (2.2-ohm) which is inserted into the input line.



MODIFICATION:

1) Remove the cold side of the Emitter Follower Out (2-core shield) and the input of the driver board of both L-ch and R-ch (single-core shield) from the earth terminal on the chassis, and connect these three wires to the U terminals of the inner socket on the R-ch driver board.

2) Prepare another black-wire, and connect the earth terminal of the input terminal and that on the chassis. Note that the black-wire should be in parallel with the Emitter Follower Out (2-core shield).

3) Remove the resistor (2.2-ohm) inserted into the cold-side of the input line.

SYMBOL NO.			LOCATION
R334	47	1/2W	Y-C
335	47	1/2W	Y-C
336	220K	1/2W	Y-C
337	100	1W	Y-A
338	100	1W	Y-C
339	220K	1/2W	Y-B
VR301	5K-B		X-A
302	1K-B		X-C
C302	100mfd	16V	Y-A
303	0.1mfd	250V	Y-A
304	220pfd	50V	Y-A
305	220mfd	16V	X-A
306	220mfd	16V	X-A
307	0.1mfd	250V	X-A
308	330pfd	500V	X-A
309	2.2mfd	250V	Y-A
310	33mfd	16V	Y-A
311	100mfd	100V	Y-B

SYMBOL NO.			LOCATION
C312	33pfd	100V	X-A
313	1mfd	250V	X-C
314	100mfd	100V	Y-C
315	1mfd	250V	Y-B
316	1mfd	250V	Y-C
317	2200pfd	50V	Y-B
318	1mfd	250V	X-C
319	330mfd	6.3V	Y-C
320	2200pfd	50V	Y-C
321	4.7pfd	50V	Y-B
322	4.7pfd	50V	Y-B
D301	SV-02		X-B
302	SV-02		Y-C
303	SV-03		X-C
304	IS1555		Y-B
305	IS1555		Y-B
306	IS1586		Y-B
307	IS1586		Y-B

SYMBOL NO.			LOCATION
DZ301	BZ-120	1W	Y-A
Q301	2SA809-V,B		Y-A
302	2SA809-V,B		Y-A
303	2SC996-O		X-A
304	2SC996-O		X-B
305	2N5415		X-B
306	2SC515A-O		X-C
307	2SC515A-O		Y-C
308	2SC1451-V,B		Y-B
309	2SA809-V,B		Y-B
310	2SC783		Y-B
311	2SA483(S)		X-C
312	2SC783		Y-A
313	2SA483(S)		Y-C

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SYMBOL NO.			LOCATION
R401	4.7K	1/4W	Y-C
402	47	1/2W	Y-C
403	330	1/2W	X-C
404	33K	1W	Y-C
405	330	1/2W	Y-C
406	56K	1/2W	Y-C
407	33K	1W	X-C
408	3.9K	1/2W	X-C
409	10K	1W	Y-C
410	8.2K	1/2W	Y-C
411	3.9K	1/2W	X-C
412	1.2K	1/2W	Y-C
413	56K	1/2W	Y-C
414	220	1/2W	X-C
415	220	1/2W	Y-B
417	82K	1/2W	X-B
418	47	1W	Y-A
419	100K	1/2W	Y-B
421	100	2W	Y-A
422	270	1/2W	X-A
424	22	2W	Y-B
425	15	1/2W	X-A
426	330	1/2W	Y-B
427	330	1/2W	Y-A
428	47	1/2W	Y-B
429	47	1/2W	Y-B

SYMBOL NO.			LOCATION
R430	3.3K	1/2W	Y-B
431	100	1W	Y-C
432	3.3K	1/2W	Y-B
433	100	1W	Y-A
434	47	1/2W	Y-A
435	47	1/2W	Y-A
436	220K	1/2W	Y-A
437	100	1W	Y-C
438	100	1W	Y-A
439	220K	1/2W	Y-B
VR401	1K-B		X-C
402	5K-B		X-A
C402	100mfd	16V	Y-C
403	0.1mfd	250V	Y-C
404	220pfd	50V	Y-C
405	220mfd	16V	X-C
406	220mfd	16V	X-C
407	0.1mfd	250V	X-C
408	330pfd	500V	X-C
409	2.2mfd	250V	Y-C
410	33mfd	16V	Y-C
411	100mfd	100V	Y-B
412	33pfd	100V	X-C
413	1mfd	250V	X-A
414	100mfd	100V	Y-A

SYMBOL NO.			LOCATION
C415	1mfd	250V	Y-B
416	1mfd	250V	Y-A
417	2200pfd	50V	Y-B
418	1mfd	250V	X-A
419	330mfd	6.3V	Y-A
420	2200pfd	50V	Y-A
421	4.7pfd	50V	Y-B
422	4.7pfd	50V	Y-B
D401	SV-02		X-B
402	SV-02		Y-A
403	SV03		X-A
404	IS1555	1/2W	Y-B
405	IS1555	1/2W	Y-B
406	IS1586	1/2W	Y-B
407	IS1586	1/2W	Y-B
DZ401	BZ-120	1W	Y-C
Q401	2SA809-V, B		Y-C
402	2SA809-V, B		Y-C
403	2SC996-O		X-C
404	2SC996-O		X-B
405	2N5415		X-B
406	2SC515A-O		X-A
407	2SC515A-O		Y-A
408	2SC1451-V, B		Y-B
409	2SA809-V, B		Y-B
410	2SC783		Y-B
411	2SA483(S)		X-A
412	2SC783		Y-C
413	2SA483(S)		Y-A

PB-687A

SYMBOL NO.			LOCATION
R700	22	1/2W	X-A
701	22	1/2W	X-A
702	1.8K	1/2W	Y-A
703	3.3K	1/2W	X-A
704	2.2K	1/2W	X-A
705	2.7K	1/2W	Y-A
706	2.2K	1/2W	X-A
707	3.3K	1/2W	X-A
708	10K	1/2W	Y-B
709	1.5K	1/2W	Y-B
710	1K	1/2W	X-B
711	8.2k	1/2W	Y-B
712	1K	1/2W	Y-B
713	33K	1/2W	Y-B
714	8.2K	1/2W	Y-B
715	1K	1/2W	Y-B
716	18K	1/2W	Y-B
717	18K	1/2W	Y-B
718	1K	1/2W	Y-B
719	18K	1/2W	Y-B
720	1.5K	1/2W	Y-A
721	3.3K	1/2W	Y-A
722	3.3K	1/2W	Y-A
723	5.6K	1/2W	Y-A
724	3.9K	1/2W	Y-A
725	3.9K	1/2W	Y-A
726	5.6K	1/2W	Y-A
727	5.6K	1/2W	Y-A
728	3.9K	1/2W	Y-A
729	5.6K	1/2W	Y-A
730	3.9K	1/2W	Y-A
731	8.2k	1/2W	X-C
732	82K	1/2W	X-C
733	1.2K	1/2W	X-C
734	18K	1/2W	Y-C
735	18K	1/2W	Y-C
736	22K	1/2W	X-B
737	22K	1/2W	Y-B
738	2.7K	1/2W	Y-C
739	2.7K	1/2W	Y-C
740	10K	1/2W	Y-C
741	10K	1/2W	Y-C
742	3.9K	1/2W	Y-C
743	3.9K	1/2W	X-C
744	1K	1/2W	Y-B
745	1K	1/2W	Y-B

SYMBOL NO.			LOCATION
R746	18K	1/2W	Y-B
747	12K	1/2W	Y-B
748	39K	1/2W	X-B
749	22K	1/2W	X-B
750	10K	1/2W	X-B
751	22K	1/2W	X-B
752	1.8K	1/2W	X-B
753	1.8K	1/2W	X-B
754	8.2K	1/2W	X-B
755	10K	1/2W	X-B
756	1.8K	1/2W	X-B
757	8.2K	1/2W	X-B
758	1.8K	1/2W	X-B
759	3.3K	1/2W	Y-C
760	1K	1/2W	X-C
761	8.2K	1/2W	Y-C
762	1.5K	1/2W	Y-C
763	100K	1/2W	X-C
764	1K	1/2W	X-C
765	820	1/2W	X-B
766	4.7K	1/4W	X-C
VR700	1K-B		X-B
C700	100mfd	50V	Y-A
701	100mfd	50V	Y-A
702	0.022mfd	100V	Y-A
703	10mfd	50V	X-A
705	100mfd	25V	X-C
706	0.1mfd	50V	Y-C
708	100mfd	25V	Y-C
709	100mfd	25V	Y-C
710	10mfd	50V	X-B
711	10mfd	50V	X-C
727	0.1mfd	50V	Y-C
D700	WO4		Y-A
701	IS1586		X-B
702	IK188FM-1		Y-B
703	IS1586		Y-B
704	IN4003		Y-B
705	IS1586		X-B
706	IS1585		Y-A
707	IS1585		Y-A
708	IS1585		Y-A
709	IS1585		Y-A
710	IN4003		X-C

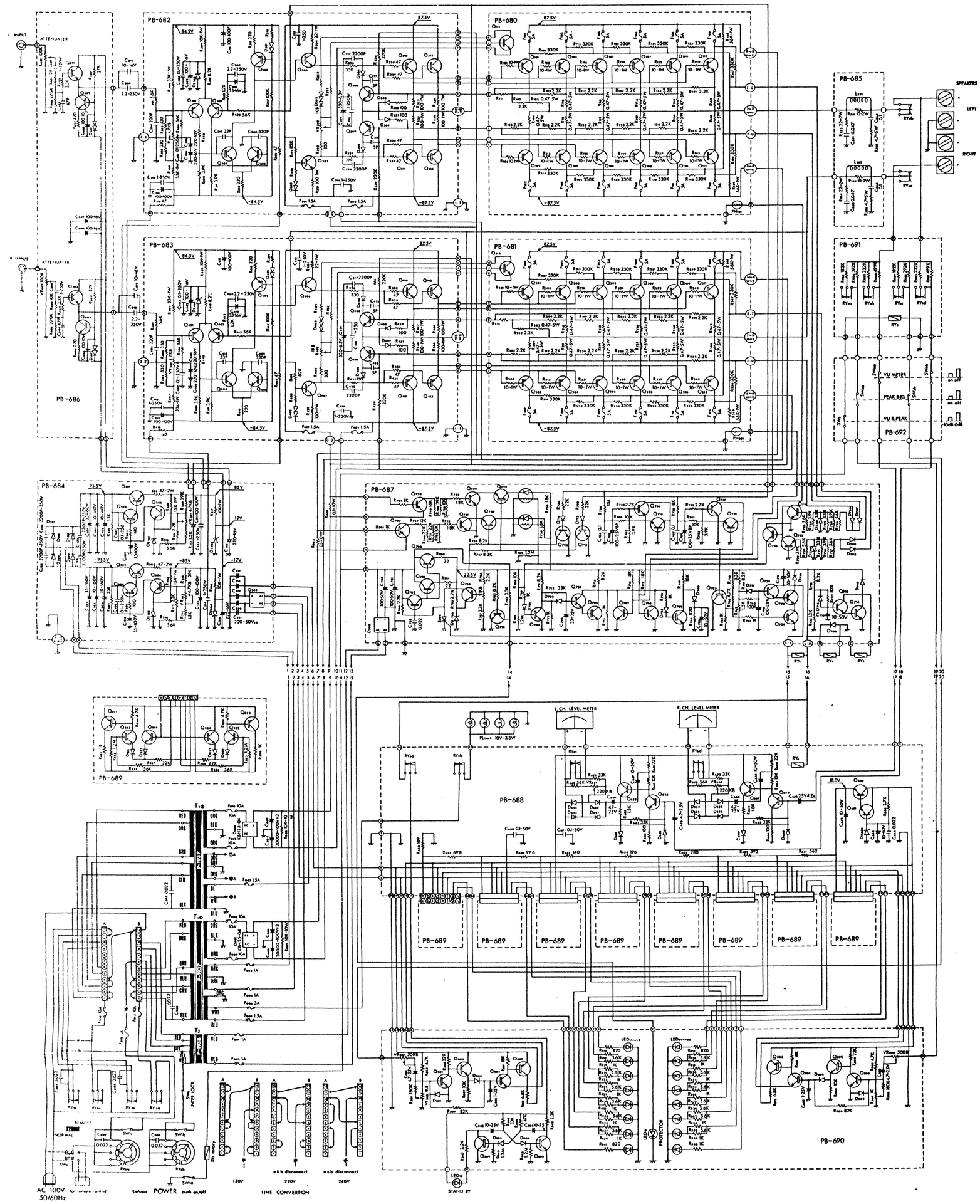
SYMBOL NO.		LOCATION
D711	IK188FM-1	X-C
712	IN4003	X-B
713	IS1586	X-B
714	IS1586	X-B
715	IK188FM-1	X-C
Z700	BZ-120 1W	Y-A
701	WZ-061 1/2W	Y-A
702	WZ-061 1/2W	Y-A
Q700	2SC1025-E	X-A
701	2SC1025-E	X-A
702	2SC734-Y	X-A
703	2SC734-Y	X-B
704	2SC734-Y	X-B
705	2SC734-Y	Y-B
706	2SC734-Y	Y-B
707	2SC734-Y	Y-B
708	2SC734-Y	Y-B
709	2SC734-Y	X-B
710	2SA561-Y	Y-B
711	2SC734-Y	Y-A
712	2SC734-Y	Y-B
713	2SC734-Y	Y-A
714	2SD331-E	X-C
715	2SC734-Y	X-C
716	2SC734-Y	Y-C
717	2SC734-Y	X-C
718	2SC734-Y	Y-C
719	2SC734-Y	Y-C
720	2SC734-Y	X-B
721	2SC734-Y	X-B
723	2SA561-Y	X-C
724	2SC734-Y	X-C
725	2SD331-E	X-C
726	2SD331-E	X-C
727	2SA809-V, B	Y-B
728	2SA809-V, B	Y-B
729	2SC734-Y	X-B
730	2SC734-Y	X-B
731	2SC734-Y	X-B
732	2SC734-Y	X-B
SCR	SFIR3D41	X-A

PB-688A

SYMBOL NO.			LOCATION
R650	2.7K	1/2W	Y-A
651	562	1/2W	X-A
652	392	1/2W	X-B
653	280	1/2W	X-B
654	196	1/2W	X-B
655	140	1/2W	X-C
656	97.6	1/2W	Y-C
657	69.8	1/2W	X-C
658	169	1/2W	Y-D
659	22K	1/2W	X-A
660	22K	1/2W	X-B
661	10K	1/2W	X-A
662	10K	1/2W	X-B
663	100	1/2W	X-A
664	100	1/2W	X-B
665	1.8K	1/2W	X-A
666	1.8K	1/2W	X-C
667	33K	1/2W	X-A
668	33K	1/2W	X-B
669	100K	1/2W	X-D

SYMBOL NO.			LOCATION
R670	100K	1/2W	X-D
671	33K	1/2W	Y-D
672	33K	1/2W	X-D
VR650	220K-B		X-D
651	220K-B		X-D
C650	0.1mfd	50V	X-A
651	0.1mfd	50V	X-A
652	10mfd	50V	Y-A
653	0.022mfd	100V	Y-A
654	10mfd	50V	Y-A
655	4.7mfd	25V	X-A
656	4.7mfd	25V	X-A
657	10mfd	50V	X-A
658	10mfd	50V	X-B
659	4.7mfd	25V	X-A
660	4.7mfd	25V	X-C
D650	IS1586		X-B
651	IS1586		X-A
652	IS1555		X-C

SYMBOL NO.		LOCATION
D653	IS1555	Y-C
654	IS1555	X-C
655	IS1555	X-C
656	IS1555	X-C
657	IS1555	Y-C
658	IS1555	X-C
659	IS1555	X-C
660	IS1586	X-B
661	IS1586	X-A
Z650	BZ-192 1W	Y-A
Q650	2SC496-Y	Y-A
651	2SC734-Y	Y-A
652	2SC734-Y	X-B
653	2SC734-Y	X-A
654	2SC734-Y	X-C
	2SC734-Y	X-A



	PW	PT, Tmo
120V	7A	3A
220V	4.5A	3A
240V	4.5A	3A

PB-682	Q301, 302, 306, 307, 309, 310	2SD355
	Q303, 304, 308, 311	2SB600
	Q312	2SA798
	Q313, 314	2SC1627
	Q315, 316	2SA809
	Q317, 318	2SC799
	Q319	2SK415
	Q320, 321	2SC1358
	Q322	2SC1431
	Q323, 324	2SD121
	Q325, 326	2SB509
	Q327, 328	2SD60
	Q329	2SC60
	D301	1S1555
	D302	1S188
	D303	RZ-120
PB-683	Q301, 302, 306, 307, 309, 310	2SD355
	Q303, 304, 308, 311	2SB600
	Q312	2SA798
	Q313, 314	2SC1627
	Q315, 316	2SA809
	Q317, 318	2SC799
	Q319	2SK415
	Q320, 321	2SC1358
	Q322	2SC1431
	Q323, 324	2SD121
	Q325, 326	2SB509
	Q327, 328	2SD60
	Q329	2SC60
	D301	1S1555
	D302	1S188
	D303	RZ-120
PB-681	Q301, 302, 306, 307, 309, 310	2SD355
	Q303, 304, 308, 311	2SB600
	Q312	2SA798
	Q313, 314	2SC1627
	Q315, 316	2SA809
	Q317, 318	2SC799
	Q319	2SK415
	Q320, 321	2SC1358
	Q322	2SC1431
	Q323, 324	2SD121
	Q325, 326	2SB509
	Q327, 328	2SD60
	Q329	2SC60
	D301	1S1555
	D302	1S188
	D303	RZ-120
PB-684	Q301	2SC783
	Q302	2SA483
	Q303 ~ 305	2SC1451
	Q306 ~ 309	2SA809
	Q310 ~ 313	IM4004
	D301	W01-4
	D302 ~ 304	RZ-100
	D305 ~ 308	2SC1424
	D309 ~ 312	SV-03
PB-688		
PB-687	Q701 ~ 709	2SC1023
	Q710 ~ 712	2SC1061
	other 20 transistors	2SC1627
	D727 ~ 729	2SC609
	D701 ~ 703, 705 ~ 707, 712 ~ 714	1S1555
	D704 ~ 711, 715 ~ 717	1S188
	D718	IM4001
	D719	RZ-120
	D720	W-C-04
	D721	FM-3041
	Q701	2SC373
	Q702 ~ 705	2SC1627
	Q706 ~ 710	1S1555
	D701 ~ 705	1S188
	D706	RZ-192
PB-689	Q801 ~ 805	2SA561
	Q806 ~ 810	2SC1627
	D801 ~ 805	1S188
PB-690	Q806 ~ 810	2SC1627
	other 8 transistors	2SC734
	D806 ~ 813	1S1555
	LED1 ~ 16, 18 ~ 33	SEL1210
PB-691	LED17	SEL1010

1 UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHM 1/2WATT, ALL CAPACITORS ARE IN MICRO-FARAD.
2 TRANSISTORS AND DIODES MAY BE REPLACED WITH ANY TYPES HAVING COMPARABLE RATINGS.
3 DUE TO CONTINUED IMPROVEMENTS LUX RESERVE THE RIGHT TO ALTER THE CIRCUIT OR SPECIFICATIONS.

ULTIMATE HIGH FIDELITY **M-6000**